

## EXPERIENTIAL DIVERSITY IN GRADUATE EDUCATION

**The National Science Foundation has awarded UB Mathematics a three-year, \$600,000 grant to support the new program, EDGE@UB, led by William Menasco, professor and director of graduate studies, in collaboration with industry and academic partners. See page 3**

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## SUPPORT UB MATH

Your support of the Mathematics Resource Fund is crucial to fulfilling the mission and goals of our department. Your tax deductible donation supports student research, activities and events, plus seminars by visiting scholars, and graduate students' dissertation defense.

To learn more about giving to the Mathematics Resource Fund, please contact David Hemmer, (716) 645-8775, or via email [dhemmer@buffalo.edu](mailto:dhemmer@buffalo.edu)

## CHAIR'S MESSAGE

We are happy to bring back our newsletter, *UB Math Matters*, as a briefing of the academic year for our alumni and friends. This is a very exciting time in our department! A major award from the National Science Foundation supports a new program, EDGE@UB, to provide internships for our graduate students with a number of industry partners. In 2016-2017 our partners are M&T Bank and Moog.

Recently, a significant donation from the Summer Math Institute of Amherst, NY, established an endowment which will support an undergraduate student each year to do summer research with a faculty mentor.

Two wonderful, new, applied math faculty joined our department this year. And although budget constraints do not allow for any hiring in the upcoming academic year, we are approved to recruit and hire two faculty in 2017. We can only hope to do as well as Sarah and Li.

In Fall 2017 we will host the American Mathematical Society's Eastern Sectional meeting. Hundreds of mathematicians will descend on UB North Campus to savor mathematics while enjoying Buffalo's beautiful fall weather.

We invite our alumni and friends to visit us for a tour of our building. For a virtual tour of our department, explore our new website. There you will find current updates on the successes of our faculty, students, and overall program.

In this era of dwindling state funds for education, please know that individual and corporate donations are very much needed and deeply appreciated. I promise that your donation will be put to the best possible use.

Best wishes,  
Dave Hemmer, Chair, Department of Mathematics

## NEW ENDOWMENT



Starting next summer, a UB mathematics major will be the first to receive the "Summer Math Scholarship" to pursue individual research with a faculty mentor.

The Summer Math Foundation, Inc. of Amherst, NY, has funded the program for 2017 and simultaneously established an endowment to support the program for future summers.

Each fall, potential scholarship recipients will apply jointly with a willing faculty mentor, writing up a description of the proposed research and the hoped for outcomes. The department's undergraduate studies committee will select the winner. During the Spring semester the student will register for an independent study, including literature review and discussion of research tools.

The six-week full-time summer program will include a stipend of \$3000. The following academic year the research will be written up into a senior honors thesis. The foundation has also included funding for the preparation of a research tools guide book for use by the scholarship recipients.

Mathematics Department Chair David Hemmer said he was thrilled with the news of the donation. "Each year we have mathematics majors who wish to pursue summer research but, for financial reasons, are forced to find a regular job instead. This funding allows such a student to have a year-long, one-on-one research interaction with the faculty mentor without sacrificing financially. Such experiences are enormously valuable for students considering graduate school in mathematics."

Details about how to apply for the scholarship will be forthcoming in the fall semester.

## UNDERGRADUATE STUDENT AWARDS



*Pictured above, Jessica Eisenhauer, center, surrounded by family receives the Department of Mathematics 2016 Graduate Certificate of Summa Cum Laude. The award was presented by (from left) Dr. Bernard Badzioch, Director of Undergraduate Studies, and Dr. David Hemmer, UB Math Chair. Photograph by Dr. John Ringland.*

UB Math held a commencement ceremony on May 15, 2016, followed by a reception for graduates, their families, and faculty, where the department's outstanding senior, Jessica Eisenhauer, was honored and made some brief remarks.

Jessica graduates summa cum laude with a Bachelor of Science degree in mathematics and minors in economics and statistics. Jessica, an Honors College Scholar, is a recipient of the UB Provost Scholarship, the Masonic Patriotic Scholarship, and the Scottish Rite Scholarship.

While excelling in college courses, she has been involved in several extracurricular activities. She worked on research projects at the Industrial Engineering Department, and served as a teaching assistant in the Department of Mathematics.

Jessica also completed internships at Independent Health in Buffalo, and at Liberty Mutual in Boston. This fall, Jessica will return to the Math Department to pursue a PhD in mathematics.

## GRADUATE STUDENT AWARDS

The Department of Mathematics is pleased to announce the recipients of the 2016 Excellence in Graduate Student Teaching. Criteria is based on multiple classroom observations, teaching evaluations and recommendations from supervising faculty.

Winning the top awards, including a \$750 prize, were Megan Johnson and Tara Hudson. Winning honorable mention awards, including a \$250 prize, were Abdalrazzaq Zalloum and Naijiang Zeng. The awards were presented by David Hemmer, Chair, at the Department of Mathematics faculty meeting on May 5, 2016. Visit our website to see more about 'Our Students'.

[www.math.buffalo.edu](http://www.math.buffalo.edu)

## UB MATH WINS NSF FUNDING FOR EDGE@UB EXPERIENTIAL DIVERSITY IN GRADUATE EDUCATION

The National Science Foundation (NSF) has awarded the University at Buffalo Mathematics Department a three-year, \$600,000 grant to support the new program “EDT-Experiential Diversity in Graduate Education” (EDGE@UB).

Led by mathematics professor and director of graduate studies William Menasco, EDGE@UB is a collaboration initiative with industry and academic partners including IBM’s Buffalo Innovation Center, M&T Bank, Moog Inc., Secure RF Corporation and the UB School of Management.

Co-principal investigators on the project are four other mathematics faculty including David Hemmer, Bernard Badzioch, Joseph Hundley and John Ringland.

UB is only the fourth institution to be funded through this initiative; the others are Princeton, Minnesota and the University of Texas at Dallas.

The NSF’s goal for EDT is to “strengthen the nation’s scientific competitiveness by increasing the number of well-prepared U.S. citizens, nationals, and permanent residents who pursue careers in the mathematical sciences and in other professions in which expertise in the mathematical sciences plays an increasingly important role.”

EDGE@UB will support efforts to enrich research training in the mathematical sciences at the doctoral level by preparing Ph.D. students to recognize and find solutions to mathematical challenges arising in other fields and in areas outside today’s academic setting.

Mathematics doctoral students in EDGE@UB participate in a yearlong training program culminating in a summer internship working onsite with the partners. Menasco states, “Today’s mathematicians have career options beyond just academia.”

The grant is expected to fund half a dozen students each year in two cohorts. The first cohort of students will be selected in Fall 2016.

Each industry partner has a specific proposed problem suitable for EDGE@UB students to work on. The current participants and tentative problems are:

IBM Buffalo Innovation Center  
Training of Watson.

M&T Bank  
Understand behavior of homeowners with home equity lines of credit.

MOOG, Inc.  
Improved understanding of the mathematics governing mechanics of ball screws.

Secure RF Corporation  
Test security protocols based on braid groups and finite fields.

UB School of Management  
Stochastic optimization, network outages.



National Science Foundation  
WHERE DISCOVERIES BEGIN

## Emeritus Professor Stephen Cavior reflects on fifty years of teaching, research, and service



**Stephen Cavior is the longest serving professor in the history of our department, giving 50 years to UB Math before his 2013 retirement.**

**He earned his BA from Swarthmore College in 1959 and his doctorate from Duke in 1963, joining our department immediately afterward. This was a time of torrid hiring in the department; Steve was one of eight new faculty members to arrive in the Fall of 1963.**

**Steve advised almost 50 master's students. He continues to come into the department several times each week, and we had an opportunity to catch up with Steve and ask a few questions.**

*Stephen Cavior, Professor Emeritus, UB Mathematics*

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### *What were your favorite courses to teach?*

One was certainly Abstract Algebra. But I didn't get to teach it all that often because it was very popular with the faculty and I had to wait my turn. I always found it fun to guide the class through what I consider a mathematical wonderland where sets and actions become the objects of other sets. And it was very rewarding to watch the students become more comfortable with these strange new ideas.

Two others favorites were Combinatorics and Graph Theory, which I designed and first offered in the 1980s. Both of these courses have had a wonderful following over the years.

### *You have advised far more master's students than anyone else on the faculty. How many and why so many !?*

In 1969 I became the director of the UB Summer Mathematics Institute, which was one of the programs funded by the NSF right after Sputnik to strengthen the preparation of high-school teachers. In our program the teachers studied here for four

consecutive summers, taking three courses every year from a comprehensive list of a dozen. The final requirement for the Master's Degree was to complete a project, and as director, it was my responsibility to be the supervisor. Typically a student would write a project showing how to structure a course for a high school audience based on topics from a subject he had just studied here. I offered encouragement and critical feedback about what could or couldn't work, and needless to say there were many rewrites. Forty-five of my Master's students came through this program, and another wrote a thesis in number theory.

### *How has the department changed over the years?*

The most obvious change I see is that the new tenure requirements and the pressure to get grants have made the department a more anxious place. Also, chronic budget problems have limited our course offerings and boosted average class size.

*Interview continues on page 5*

*Cavior interview continued from page 4*

What I remember best from my early days here is how smoothly and cooperatively the new and the senior faculty worked together to develop our programs and extend our reach more regionally and nationally.

New faculty especially were encouraged to offer courses or seminars in their specialties, even if they drew only small enrollments, and we younger folks felt real excitement in knowing that we were helping to move the department in a new direction. I wish that every young person could feel that excitement at the start of a career.

Another happy memory was the remarkable sociability of the group, and I don't mean only the parties. It was pretty typical for a dozen people to take a colloquium speaker to dinner, and it didn't matter if you were an algebraist or a topologist. It was just something we all wanted to do together. And the graduate students were involved in our social functions, too.

#### *How have the students changed over the years?*

With all the new courses and programs available at UB today, students seem to be busier than ever. Years ago, when they had more time, they would often stop by my office to show me a really neat solution to a homework problem, or just to talk about some class topic that caught their interest. Those conversations would make my day, and I've missed having them.

#### *Any favorite piece of mathematics?*

My favorite corner of mathematics is combinatorics. My interest in it began when I was writing my dissertation and needed to study some equations over finite fields.

Over the years I've become fascinated by the complex and amazing things that combinatorial arguments can lead to. (Talk about elegant proofs!)

When I was in graduate school there were very few books on the subject, and relatively little research activity in it, but today it's an important and busy field with broad applications in science and technology. And there are even movies about it!

#### *Any advice to give today's graduates?*

My advice would be this: read very widely, because you never know when an idea may prove to be helpful. A good example of this is in the coding theory text by Sloane and MacWilliams, where they solve their problems using algebra, linear algebra, geometry, combinatorics, and complex variables. And of course interests outside of mathematics are essential for balance.

#### *Plans for retirement?*

For the time being I'm going to stay put. I want to complete some writing projects and then take a year to regroup and decide what my new focus will be. In the meantime I want to enjoy more of the cultural life of UB and of the community. Also, I'd like to return to music. I used to play classical guitar and have let that slide.

#### *Anything else you'd like to add?*

This is said with the utmost sincerity and honesty. In looking back on my long career, I'd say that I've been the luckiest of people. I've had the tremendous honor and privilege of teaching young men and women, and telling them about a subject of great beauty and importance.

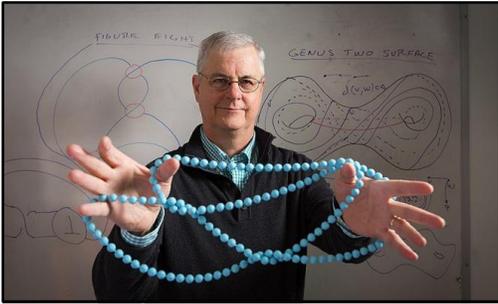
My job has allowed me to remain a lifelong student, and all the while I've been here I've had a very companionable bunch of colleagues. Also, I've been blessed with a group of chairs who for the most part were always willing to listen to my ideas. So if that doesn't make a perfect job, I don't know what does.

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*Steve would be delighted to hear from his students, friends and colleagues.  
His email is [cavor@buffalo.edu](mailto:cavior@buffalo.edu)*

## FACULTY FEATURED IN UB REPORTER

### *Attention, industry: Got a problem? Call on UB mathematicians*



Article by Charlotte Hsu, Fall 2015

You may not have heard of knot theory. But take it from Bill Menasco, a knot theorist of 35 years: This field of mathematics, rich in aesthetic beauty and intellectual challenges, has come a long way since he got into it.

It involves the study of mathematical knots, which differ from real-world knots in that they have no ends. You can think of each one as a string that crosses over itself a given number of times and then reconnects with itself to form a closed loop.

“It was considered a very esoteric field when I started in it, but it has grown immensely and grown in all different directions,” says Menasco, professor of mathematics, College of Arts and Sciences.

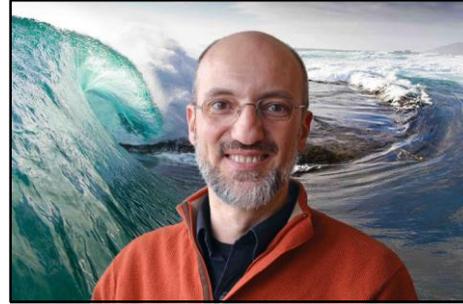
Today, we know the study of knots could have applications in surprising areas. It could enable security firms to create better encryption systems or elucidate the mysteries of how the body unravels DNA, Menasco says.

He’s a researcher who loves what he does: His office is filled with knot paraphernalia, and he can draw and build 3-D versions of complex knots from memory.

In the article, Menasco reflects on the evolution of knot theory, from its whimsical, 19th-century beginnings to its uses in the modern world.

Visit our website news page for the article, “Menasco’s Knot Challenge”. Also see an entertaining video of Menasco demonstrating knotty problems.

### *A mathematical advance in describing waves*



Article by Charlotte Hsu, Spring 2016

One of the great joys in mathematics is the ability to use math to describe phenomena seen in the physical world, says UB mathematician Gino Biondini.

With UB postdoctoral researcher Dionyssios Mantzavinos, Biondini has published a new paper that advances the art — or shall we say, the math — of describing a wave. The findings, published Jan. 27 in *Physical Review Letters*, are thought to apply to wave forms ranging from light waves in optical fibers to water waves in the sea. The new study explores what happens when a regular wave pattern has small irregularities, a question that scientists have been trying to answer for the past 50 years.

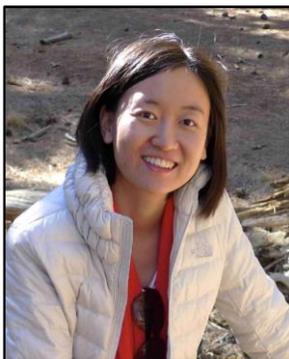
Researchers have long known that in many cases such minor imperfections grow and eventually completely distort the original wave as it travels over long distances, a phenomenon known as “modulational instability.” But the UB team has added to this story by showing, mathematically, that many different kinds of disturbances evolve to produce wave forms belonging to a single class, denoted by their identical asymptotic state.

“Ever since Isaac Newton used math to describe gravity, applied mathematicians have been inventing new mathematics or using existing forms to describe natural phenomena,” says Biondini, a professor of mathematics in the College of Arts and Sciences and an adjunct faculty member in the physics department. “Our research is, in a way, an extension of all the work that’s come before.”

Visit our website for the full article, “Biondini describes the essence of waves.”

**NEW FACULTY**

**Sarah Muldoon** joined UB Math in August 2015, coming from the bioengineering department at the University of Pennsylvania. Her research involves novel techniques and measures to investigate and quantify the role of network organization in brain function. See Sarah Muldoon's faculty profile page on our website to learn more about her research.



**Li Wang** joined UB Math in January 2016, coming from the mathematics department at the University of California Los Angeles. Wang recently published An asymptotic-preserving scheme for the semiconductor Boltzmann equation toward the energy-transport limit. See Li Wang's faculty profile page on our website to learn more about her research.

**NEW PhD GRADUATES**

**Bingbing Liang**

**"Mean Dimension, Mean Length, and Von Neumann-Luck Rank"**

**Committee Chair: Dr. Hanfeng Li**

**Adam Orenstein**

**"Quasicontinuous functions on the unit circle and Teoplitz operators in symmetric normed ideals"**

**Committee Chair: Dr. Jingbo Xia**

**Michael Rosas**

**"On the structure of Specht modules in weight three blocks of symmetric group algebras"**

**Committee Chair: Dr. David Hemmer**

**Dennis Ruppe**

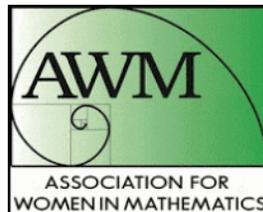
**"On the AJ-conjecture for certain families of satellite knots"**

**Committee Chair: Dr. Xingru Zhang**

**Matthew Sartwell**

**"Detecting Mapping Spaces and Derived Equivalence of Algebraic Theories"**

**Committee Chair: Dr. Bernard Badzioch**

**NEW UB AWM CHAPTER**

Through our UB AWM student chapter, we hosted social events which connected our organization to other women in STEM groups in the area along with starting a female lecture series. The goal of the UB AWM lecture series is to provide undergraduate and graduate students with strong female mentors who work in the mathematical sciences.

Some of the speakers for the lecture series this past year were mathematicians who worked at industry jobs, such as the NSA, Moog, and HealthNow. We also included speakers in academia whose talks ranged from their research areas to their mathematical journey throughout their career.

The Spring 2016 UB AWM lecture series featured "A Look at the Crypt at the NSA: An Overview of Public Key Cryptography" by UB Math Alumna, Dr. Alyssa Thompson. Thompson (née Brown) earned her Bachelor of Science degree in Applied Mathematics from UB in 2008. A native of Western New York, she earned her Master's in 2010, and her PhD in 2012.

While studying as a UB Math graduate student, Thompson spent one summer at the National Security Agency's Graduate Student Mathematics Program. Thompson's doctoral thesis, advised by UB Math Professor Tom Cusick, studied affine equivalence of some rotation symmetric boolean functions along with recursive weights of some boolean functions. After graduation Thompson was hired full-time by the NSA. She remains there today, working on designing (top secret!) new cryptosystems.

While on campus, Thompson agreed to an interview as a feature in the 'Our Alumni' section of our website, [www.math.buffalo.edu](http://www.math.buffalo.edu)

**Chapter Advisors**

Johanna Mangahas  
Sarah F. Muldoon

**Chapter Officers 2015-2016**

Alyson Bittner, President  
Ellyn Sanger, Vice President  
Tara Hudson, Treasurer  
Elizabeth Reid, Secretary

**UB AWM Chapter Contact:** [ellynsan@buffalo.edu](mailto:ellynsan@buffalo.edu)

**Facebook:** [www.facebook.com/UBAWM](http://www.facebook.com/UBAWM)

## STUDENTS WIN NSF

### Graduate Research Fellowships



The National Science Foundation Graduate Research Fellowship Program (GRFP) named a record number of winners from UB this year, one more than all the awards given to students in the rest of the SUNY system. For the 2016 competition, NSF received nearly 17,000 applications, and made 2,000 awards.

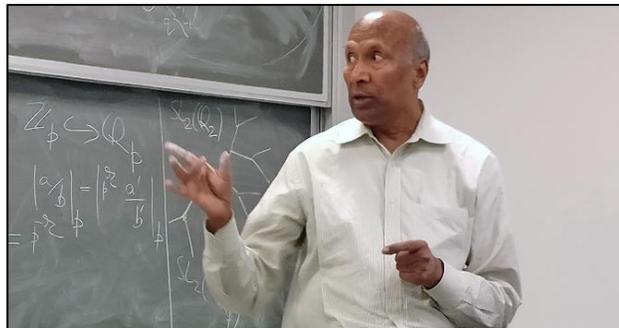
Out of eight fellowship winners from UB this year, three were math majors:

- **Thomas Effland**, graduate in applied mathematics program; currently a graduate student at Columbia University.
- **Goeffrey Fattin**, double major in applied mathematics and physics.
- **Dante Iozzo**, double major in mathematics and physics.

Two additional math majors who applied for NSF Fellowships, Michelle Karker and Matthew Morse, received honorable mentions.

## MYHILL LECTURE SERIES 2016

### Gopal Prasad, “Number Theory in Geometry”



Gopal Prasad, the Raul Bott Professor of Mathematics at the University of Michigan, delivered the prestigious Myhill Lectures Series on October 18, 19 and 20, 2016.

The lecture series, titled “Number Theory in Geometry,” drew an overflow crowd to Math 250 for the first talk, an introduction to the history of number theory in geometry.

In the second lecture Prasad discussed his groundbreaking work giving a complete classification of the so-called “fake projective planes.” The final lecture was devoted to the famous mathematical question, “Can you hear the shape of a drum.” The answer is “No”, as there are examples of two drums with completely different shapes that sound exactly alike. Such objects are known as isospectral but not isometric manifolds. Prasad’s work shows that in higher dimensions with some reasonable assumptions the answer is “Yes”!

[Visit our website](http://www.math.buffalo.edu) to learn more about the Myhill Lecture Series. There you can read Gopal Prasad’s abstract and bio, follow links to resources, and see video clips of all three of his lectures for UB Math. [www.math.buffalo.edu](http://www.math.buffalo.edu)